## Claims

What is claimed is:

1. A method for determining the location of a performance problem in a network-based communication system comprising a plurality of endpoint devices, the method comprising the steps of:

generating test communications in the system in accordance with a selected pattern;

collecting end-to-end path measurement data utilizing the generated test communications; and

transforming the end-to-end path measurement data to produce a plurality of performance indicators comprising a performance indicator for each of a plurality of non-end-to-end paths defined at least in part by the selected pattern.

2. The method of claim 1 wherein a given one of the test communications is directed between a first one of the endpoint devices and a second one of the endpoint devices.

3. The method of claim 1 wherein for a given time interval the collected end-to-end path measurement data is characterized by the equation:

$$\mathbf{y} = \mathbf{A}\mathbf{x}$$

where **y** is a vector of end-to-end path measurements, **A** is a flow matrix defining the selected pattern, and **x** is a vector of network link-level performance indicators.

4. The method of claim 3 wherein the transforming step comprises utilizing **y** and **A** to solve the equation for **x**.

5. The method of claim 1 further comprising repeating the generating, collecting and transforming steps for each of a plurality of time intervals.

6. The method of claim 5 wherein the end-to-end path measurement data corresponding to the one or more test communications generated for an *i*th time interval $t_i$ is of the form:

$$\mathbf{y_i} = \mathbf{A_i x_i}$$

where $\mathbf{y_i}$ is a vector of end-to-end path measurements collected for the *i*th time interval, $\mathbf{A_i}$ is a flow matrix defining the selected pattern for the *i*th time interval, and $\mathbf{x_i}$ is a vector of network link-level performance indicators for the *i*th time interval.

7. The method of claim 1 wherein at least one of the performance indicators comprises a binary indicator, the binary indicator taking on a first value to indicate that a corresponding link is not associated with a performance problem, and taking on a second value to indicate that the corresponding link is associated with a performance problem.

8. The method of claim 1 wherein a network of the network-based communication system has a topology characterized by a connected network topology graph $G = (D, L)$ where $D$ is a set of nodes and $L$ is a set of links, and where a given path in $G$ comprises a sequence of links from the set $L$.

9. The method of claim 8 wherein a node in $G$ having an endpoint device associated therewith is designated as a leaf, and a set $E \subset D$ denotes the set of leaves in $G$, and further wherein a path in $G$ that lies between leaves comprises an end-to-end path, and a set $P$ for a given $G$ and $E$ denotes the set of all end-to-end paths in $G$ between endpoint devices in $E$.

10. The method of claim 1 wherein the selected pattern is defined by a flow matrix having rows representing end-to-end paths for which measurement data is collected in the collecting step, and columns representing single-link or multiple-link non-end-to-end paths for which performance indicators are determined in the transforming step.

11. The method of claim 10 wherein the flow matrix comprises an $n \times m$ matrix wherein for $0 < i \leq n$ and $0 < j \leq m$, $m_{ij}$ denotes the number of times the end-to-end path in row $i$ traverses the non-end-to-end path in column $j$.

12. The method of claim 10 wherein the flow matrix comprises a singular matrix.

13. The method of claim 10 wherein the flow matrix comprises a non-singular matrix.

14. The method of claim 1 wherein the selected pattern is determined at least in part based on a reduced network topology generated by applying a network topology reduction process to a graph representative of a topology of a network of the network-based communication system, the network topology reduction process determining one or more non-end-to-end paths within the network which carry the same traffic flow.

15. The method of claim 1 wherein the selected pattern is determined at least in part utilizing a flow matrix selection algorithm.

16. The method of claim 15 wherein the flow matrix selection algorithm maintains a list of end-to-end paths and processes said list such that a plurality of non-end-to-end paths for which performance indicators can be generated are determined.

17. The method of claim 15 wherein the flow matrix selection algorithm is configurable to accept one or more constraints on selection of particular paths in generating a given flow matrix.

18. An apparatus for use in determining the location of a performance problem in a network-based communication system, the system comprising a plurality of endpoint devices, the apparatus comprising:

a controller comprising a processor coupled to a memory;

the controller being associated with one or more of the endpoint devices, and being operative to control: (i) generation of test communications in the system in accordance with a selected pattern, (ii) collection of end-to-end path measurement data utilizing the generated test communications, and (iii) transformation of the end-to-end path measurement data to produce a plurality of performance indicators comprising a performance indicator for each of a plurality of non-end-to-end paths defined at least in part by the selected pattern.

19. The apparatus of claim 18 wherein the controller comprises a centralized controller which communicates with the plurality of endpoint devices over a network.

20. The apparatus of claim 18 wherein the controller comprises a distributed controller which is implemented at least in part utilizing one or more of the endpoint devices.

21. An article of manufacture comprising a machine-readable storage medium containing software code for use in determining the location of a performance problem in a network-based communication system comprising a plurality of endpoint devices, wherein the software code when executed implements the steps of:

generating test communications in the system in accordance with a selected pattern;

collecting end-to-end path measurement data utilizing the generated test communications; and

transforming the end-to-end path measurement data to produce a plurality of performance indicators comprising a performance indicator for each of a plurality of non-end-to-end paths defined at least in part by the selected pattern.